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**AT BE CH DE DK ES FR GB GR IT LI NL SE**(71) Applicant: **UNILEVER N.V.**  
**Burgemeester s'Jacobplein 1 P.O. Box 760**  
**NL-3000 DK Rotterdam(NL)**(84) **BE CH DE DK ES FR GR IT LI NL SE AT**(71) Applicant: **UNILEVER PLC**  
**Unilever House Blackfriars P.O. Box 68**  
**London EC4P 4BQ(GB)**(84) **GB**(72) Inventor: **Balley, John**  
**Colworth House**  
**Sharnbrook, Bedford, MK44 1LQ(GB)**  
Inventor: **Dale, Christopher Paul**  
**Colworth House**  
**Sharnbrook, Bedford, MK44 1LQ(GB)**  
Inventor: **Graber, Hans Jürgen**  
**Colworth House**  
**Sharnbrook, Bedford, MK44 1LQ(GB)**  
Inventor: **Hall, Spencer William**  
**Colworth House**  
**Sharnbrook, Bedford, MK44 1LQ(GB)**  
Inventor: **Richards, Jeffrey Bryn**  
**Colworth House**  
**Sharnbrook, Bedford, MK44 1LQ(GB)**  
Inventor: **Silvestri, Carlo**  
**Via Mulini Militari 42**  
**I-81100 Caserta(IT)**(74) Representative: **Roscoe, Brian Corrie et al**  
**UNILEVER PLC Patents Division Colworth**  
**House Sharnbrook**  
**GB-Bedford MK44 1LQ(GB)****EP 0 498 972 A1**(54) **Method for blanching or part-cooking vegetable material.**

(57) Blanching or part-cooking vegetables by heating with saturated steam and simultaneously microwaving, which may be intermittently, for instance in a combined apparatus (1), and thereafter quickly cooling, preferably by spraying with finely divided water of 5°C or less and preferably of -0°C to -10°C, for instance transporter (12) under spraying device (13).

The present invention relates to a method for blanching or part-cooking vegetable material comprising heat treating it in the presence of water and thereafter quickly cooling it down.

The expressions "blanching" and "part-cooking" or "pre-cooking" have roughly the same meaning: "blanching" means heating to a sufficient extent to stop the enzymatic activity of vegetable material, while "part-cooking" means a further heating whereby at least some softening of the tissue is obtained.

Several types of blanching or part-cooking methods are known in the art such as transferring the vegetable material from a container with cold washing water to successive containers containing water of increasing temperatures and finally to a container with cold water for cooling it down again. The use of direct steam for heating water in these containers is well known. In some instances cold water sprays are used instead of immersion cooling to prevent excessive leaching of valuable nutrients. Despite these possibilities there is a continuing need for blanched or part-cooked vegetables, intended for frozen or chilled distribution, of improved quality. This improved quality refers to nutrition, appearance, taste and texture.

It has unexpectedly been found that by suitably combining several processing variables this quality improvement can be achieved. Essential for achieving the aimed quality improvement is contacting the vegetable material with saturated steam while it is supported on a moving conveyor and while it is not submerged in a liquid and exposing said material at least during part of this treatment to microwave radiation. In a preferred embodiment for the quality improvement, the heat treated vegetable material is subsequently cooled down by contacting it with finely divided water (liquid or solid) having a temperature not exceeding 5°C and preferably having a temperature between 0°C and -10°C. The use of frozen, finely divided water results in a very quick cooling step whereby the overall quality is increased. To obtain water in a finely divided, solid form it is preferable to contact it with a cryogenic material before it is brought into contact with the vegetable material, whereby a very fast cooling rate can be achieved without undesirable dehydration.

For reducing the degradation of colours and nutrients it is preferred that the oxygen content of the atmosphere around the vegetables while contacting these with steam is reduced with respect to atmospheric air. In order to reduce the blanching or cooking time, pressurized steam may be used. In a preferred embodiment for limiting the taste deterioration as far as possible, the vegetables are supported on a trough shaped belt conveyor, capable of retaining at least a considerable part of any

juices exuded from the vegetables. By doing so the vegetables are heated in a moist and flavoured environment. The optimal conditions of time, temperature, steam pressure and microwave power depend on the vegetable to be treated and should be determined empirically.

The invention will be further illustrated on hand of the following examples of some embodiments, reference being made to the drawing in which Figure 1 is a schematic longitudinal sectional view of a blanching equipment and Figure 2 is a cross sectional view along the line II-II in Figure 1.

The equipment schematically shown in Figures 1 and 2 comprises a cylindrical tube 1, forming a pressure chamber, having a water bath 2 for producing saturated steam and an outlet 3. Saturated steam can conveniently be generated by evaporating water from the water bath 2 by sufficiently heating this water. This heating may be effected by bubbling direct dry steam through the water using one or more steam injectors 17 or preferably by indirect steam heating using a heat exchanger 18. The water level is continuously maintained in the bath 2. The pressure in the tube 1 is continuously regulated and can be read on the pressure gauge 4.

Inside the tube a solid longitudinal conveyor belt 5 is mounted on reversing rollers 6, the upper run being supported on concave shaped (diabolo) supporting rollers 7, giving the belt a trough shape, suitable for retaining some fluid thereon. Vegetables may be fed onto the belt through a feeding conduit 8 comprising a star wheel 9. These vegetables are conveyed on the upper run of the conveyor from the receiving end underneath the feeding conduit 8 to the dispensing end.

A dispensing conduit 10 comprising a star wheel 11 is arranged underneath the dispensing end, opening onto a steel mesh conveyor 12 above which spray nozzles 13 are arranged for dispensing a finely distributed spray of water onto the product on the steel mesh conveyor.

The tube 1 is provided with a plurality of microwave emitters 14, which are connected to the tube 1 by suitably dimensioned tubes 15. The emitters are powered and controlled by a common power and control station 16. Each microwave emitter 14 can be adjusted to emit continuously or intermittently at levels between 0 and 100% of full microwave power.

#### Example I:

Carrots of 1 to 1½ cm diameter and chopped into lengths of about 3 cm were fed onto conveyor 5. Wet steam of 106°C was supplied to tube 1 where a pressure of 1.25 atm. was maintained. The residence time of the carrots was 2 mins and

during their travel on the conveyor belt they were six times exposed to microwave radiation, supplied by six separate microwave emitters 14, each having a capacity of 1.2 kW.

During the above described heat treatment some juice exuded from the carrots, which was retained on the belt 5 because of the trough shape thereof.

At the dispensing end the carrots fell into the funnel shaped receiving end of the dispensing conduit 10 and left the pressurized tube through star wheel valve 11 onto steel mesh belt 12.

This belt was driven at a speed of 1 m/min. Twelve bat wing shaped spray nozzles 13 were arranged at intervals of 25 cm over the belt for supplying flat, triangular sprays of finely divided water onto the carrots. The water supply was cooled to about +2°C. By doing so the carrots were cooled down to +5°C in 3 mins.

This speed of cooling may be increased by spraying finely distributed liquid air or other cryogenic material into the water sprays.

The pre-cooked carrots were tastier and of better structure than carrots of the same size pre-cooked with direct steam of atmospheric pressure or with hot water and thereafter cooled with running tap water of 9°C.

#### Example II

Green beans being about 3 to 5 mm thick were fed onto the belt 5, while saturated steam was supplied to the tube 1 at atmospheric pressure. The residence time of the beans in the tube was 2½ mins, during which they were three times exposed to microwave radiation, using the first, second and third emitter 14 only.

Cooling was effected using water of 0°C, whereby the temperature of the beans was reduced from 90°C to 5°C in 1½ mins.

Beans of a better colour and taste and having a crispier structure than beans partially cooked in hot water at 98°C for 6 mins and thereafter cooled in running tap water of 9°C were obtained.

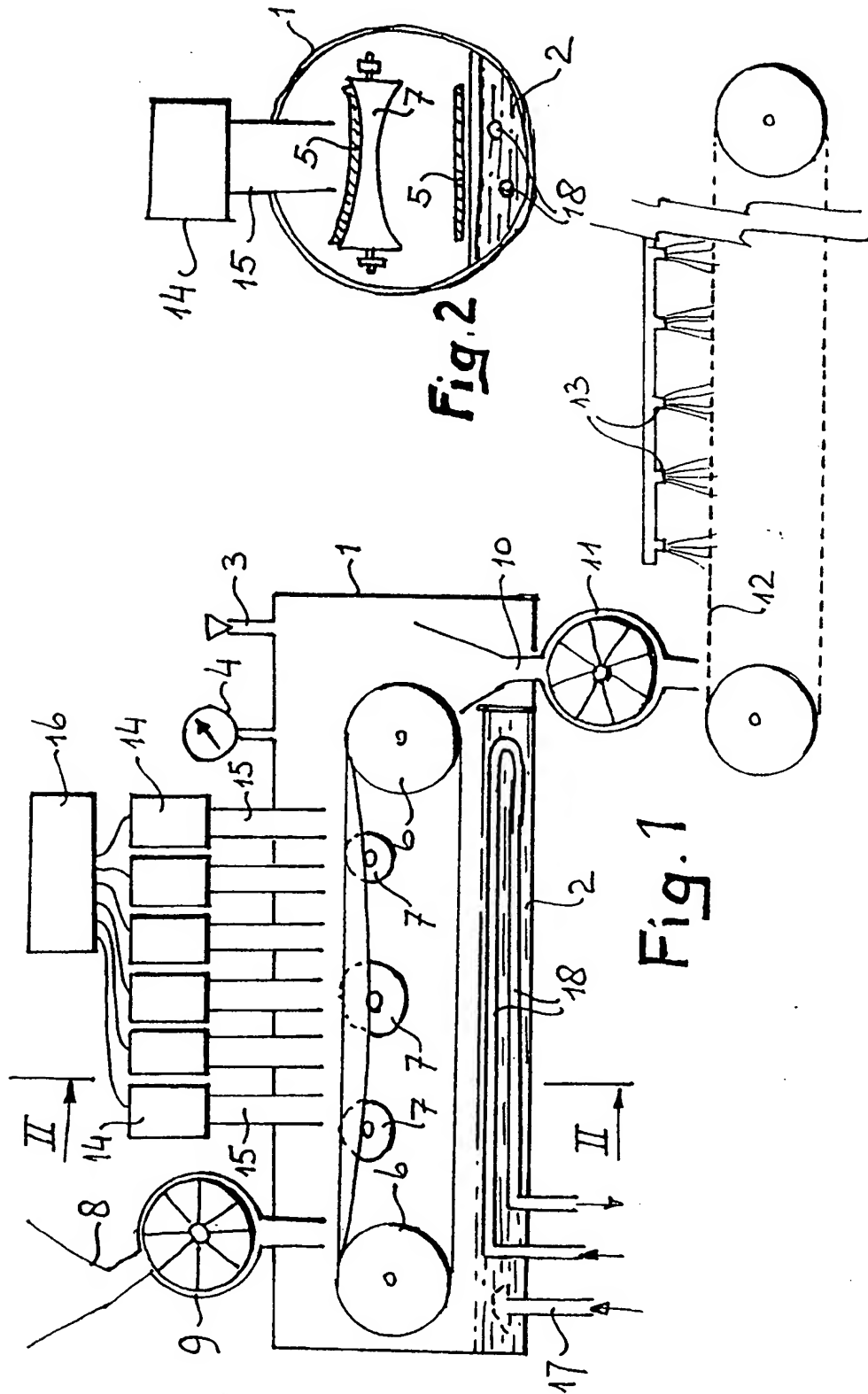
#### Example III

Yellow paprika strips (roughly 100 x 5 x 3 mm) were fed onto the belt 5 while a water saturated atmosphere at 85°C was generated in the tube 1. The residence time of the product in the tube was 55 secs, during which they were six times exposed to microwave radiation in a sequence of decreasing power. Cooling was effected using water at 0°C for 40 secs.

The paprika strips had better texture and taste than those blanched in water at 90°C for 35 secs.

#### Claims

1. A method for blanching or part-cooking vegetable material comprising heat treating it in the presence of water and thereafter quickly cooling it down, characterized in that the vegetable material is contacted with saturated steam while supported on a moving conveyor and not submerged in a liquid and at least during part of this treatment is exposed to microwave radiation.
2. A method according to claim 1, characterized in that the vegetable material is cooled down by contacting it with finely divided water having a temperature not exceeding 5°C and preferably having a temperature between 0°C and -10°C.
3. A method according to claim 2, characterized in that the water is contacted with a cryogenic material before it is contacted with the vegetable material.
4. A method according to claims 1-3, characterized in that the vegetable material is contacted with steam in an atmosphere having a lower oxygen content than atmospheric air.
5. A method according to claims 1-4, characterized in that the vegetable material is contacted with pressurized steam.
6. A method according to claims 1-5, characterized in that the vegetable material is supported on a trough shaped belt conveyor capable of retaining at least a considerable part of any juices exuded from the vegetable material.





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## EUROPEAN SEARCH REPORT

Application Number

EP 91 20 3129

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-3 889 009 (S.P. LIPOMA) * Figures 5,3,4,1; abstract; column 3, lines 5-10,31-51; column 6, lines 31-41; column 7, lines 4-20 *	1,2,4,5	A 23 B 7/06 A 23 L 3/01 A 23 B 7/01
X	US-A-3 578 463 (F.J. SMITH et al.) * Figures 1-3; column 3, lines 60-65 *	1,2,4,6	
A	FR-A-2 431 261 (T. LE VIET et al.)		
A	US-A-3 961 569 (E.M. KENYON)		
A	US-A-4 409 454 (M.P. BEAUVAIS et al.)		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			A 23 G
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 03-04-1992	Examiner GUYON R.H.
<b>CATEGORY OF CITED DOCUMENTS</b>			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document			

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